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THE VALUATION OF PUBLIC UTILITIES

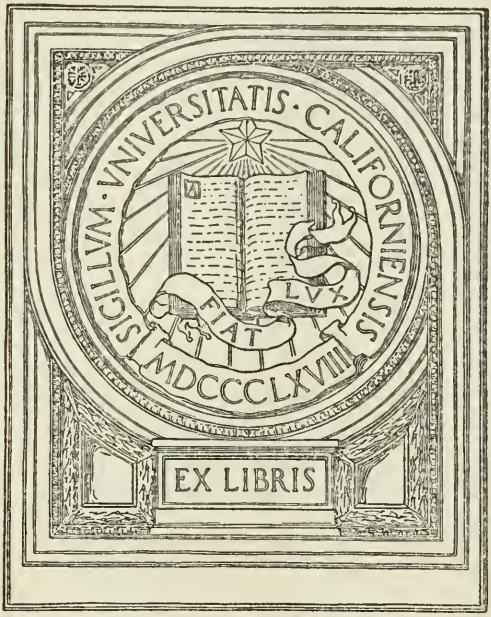
WITH SPECIAL REFERENCE TO

GAS AND ELECTRIC PROPERTIES

by

PAUL THELEN

UNIVERSITY OF CALIFORNIA
AT LOS ANGELES



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PAUL THELEN

Assistant Engineer, California Railroad Commission

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THE VALUATION OF PUBLIC UTILITIES*

SYLLABUS

Introduction—purpose and scope of paper.

Purpose of Valuation:

(*a*) Transfer.
(*b*) Taxation.
(*c*) Rates.
(*d*) Issuance of securities.

Reasons why purpose must clearly be kept in mind.

Valuation report proper involves:

(*a*) Inventory:
  (1) Tangible Capital.
  (2) Intangible Capital.
    (Classifications of Accounts for Fixed Capital).
(*b*) Unit Prices for cost to reproduce, etc.
(*c*) Original Cost:
  (1) Non-operative property.
  (2) Expenditures unwisely made.
  (3) Expenditures involving collusion.
(*d*) Cost to Reproduce:
  (1) At present day prices.
  (2) Actual performance method.
  (3) Historical Cost.
(*e*) Cost to Reproduce Less Depreciation:
  (1) Straight Line Method.
  (2) Sinking Fund Method.
(*f*) Contingencies, errors and omissions.
(*g*) Working Capital.
(*h*) Development Cost.

Application of results:

(*a*) Transfer.
(*b*) Taxation.
(*c*) Rates.
(*d*) Issuance of Securities.

Conclusion.

* Address to be delivered before Engineering Students, University of California, Apr. 6, 1916, under the auspices of the Gas Engineering Department.

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This paper will cover in a general way the subject of Utility Valuations, their purpose, scope and application. Although the audience before whom this paper is presented consists of students in an engineering class who are primarily interested in gas and electric utilities, nevertheless the subject of valuation of these utilities is but a portion of a larger field; and a discussion which covers this larger field will perhaps be of more interest to prospective gas and electric engineers than a discussion which confines itself entirely to the details involved in the valuation of a gas or electric utility. The general principles involved in the valuation of all utilities are much the same. The subject of Utility Valuations is a broad one, and will have to be covered in a very general way in order to come within the time limits which are prescribed.

The purposes for which a valution may be made are many, yet most valuations are prepared in connection with one of the following classes of proceeding:

(*a*) Transfer.
(*b*) Taxation.
(*c*) Rates.
(*d*) Issuance of Securities.

It will be well to state at the outset that the use which is to be made of a valuation must be clearly kept in mind in preparing any statement of total values or costs. Thus a valuation which is prepared for the purpose of taxation will include property which would be classed as non-operative and therefore be excluded if the valution were to be made for the purpose of rate fixing. A valution made for the purpose of transfer must, of course, include in its inventory only such property as is contemplated by the transfer. A valution for issuance of securities must involve such property as will be hypothecated in the case of a mortgage or yield income in the case of issuance of stock. We could multiply such illustrations readily.

If we follow the progress of the science of valuation engineering from its earlier days, we find that the first valutions were made almost entirely in connection with transfer of property. Here the valuation report itself was originally not a matter of great moment because it was the earning capacity rather than physical properties which had most bearing on value. It was largely a valuation to determine the depreciated cost to reproduce, sometimes loosely termed "present value."

Valuation engineering has but rarely been called upon to be of much assistance in connection with taxation matters. Such valuation statistics as have been compiled for this purpose have usually been very crude and the present tendency is to compute the tax on the basis of gross income

rather than on the basis of invested cost or cost to reproduce or depreciated cost to reproduce. It is true that the tax which is computed as a function of gross income purports generally to result in the same total amount of money as the tax computed as a function of the property value in order that there may be no discrimination between taxation of public utility properties and taxation of the property of the private individual. In the good old swashbuckling days a utility had very little need for the services of a valuation engineer. If the property were to be sold, the valuation, as far as inventory and appraisal went, was a matter of secondary importance. If the property were to be taxed, the utility had little interest in obtaining a complete inventory and making a complete and all-inclusive cost statement. But these days are definitely gone. The voice of the people has spoken in no uncertain terms, demanding fair play for the consumer, publicity of accounts, regulation of rates, service and issuance of securities, the elimination of discriminatory practices, etc., etc. The execution of the terms of the resulting legislation has been placed in the hands of Public Utility Commissions with such gratifying results that these regulating bodies have grown more and more in public esteem and in the scope of their activities until at present there are very few public utilities in the United States which are not subject to some form of supervision or regulation. Where this supervision is of rates or issuance of securities, the utility at once becomes interested in a most complete and comprehensive inventory and the proving of every possible sort of value; in short, the valuation engineer becomes a very respectable gentleman.

The work of the State Commissions, where it calls for the services of a valuation engineer, has been mainly in connection with rates. The issuance of securities comes next in order of importance; transfer of property is involved mainly in condemnation proceedings or actions brought for acquisition on behalf of an incorporated public; while taxation is a matter over which but few Public Utility Commissions now have any jurisdiction and it is probably true that these Commissions would gladly be relieved of the burden of this kind of work which very soon becomes monotonous and always involves a vast amount of detail.

The valuation report proper as involved in the work of the regulating body of the present day consists of an inventory, unit prices for each item in this inventory, and a statement of original cost, cost to reproduce and cost to reproduce less depreciation. To this completed unit of the work are added allowances for contingencies, errors and omissions to obtain a complete statement of what is termed "plant investment," to which in turn there must be added, for most purposes, working capital and, either by the engineer or the auditor, a statement of development cost.

The inventory consists of a tabulation, in proper groups, of all the property which is involved in the valuation proceedings. It is almost always advisable, in preparing an inventory, to follow the uniform classification of accounts pertinent to the utility under consideration. These classifications of accounts have been issued from time to time by the Interstate Commerce Commission at Washington, D. C., for those utilities which are concerned in interstate commerce such as steam roads, electric railways and telephone companies. The State Commissions have wisely adopted these classifications word for word for their standard, and have usually prepared additional classifications for such utilities as are subjected to regulation and engaged in business which is not classed as interstate commerce. Thus our own California State Commission has issued uniform classifications of accounts for water corporations, gas corporations, electric corporations and telephone companies, of which the last is practically identical with the classification prepared by the Interstate Commerce Commission. Our Commission further uses the Interstate Commerce Commission's Classifications for steam roads and electric railways.

Turning now to this classification for gas corporations, of which a dozen copies will be available for consultation in Professor Cory's office, we find that it concerns itself first with asset accounts and liability accounts. Of these, the former includes the fixed capital accounts in which we are particularly interested in preparing an inventory of plant, and the material and supplies accounts in which we are interested as a part of working capital. Then there is an income account and a surplus account, of which the former includes operating revenue and operating expenses. We will be interested later on in operating expense in case we desire to make an analysis of actual performance in connection with such overhead expenditures as law, injuries and damages, insurance, general office expenses, etc., all of which occur not only under conditions of operation, but also during the days of construction and must therefore be considered in the valuation report.

Turning now to the fixed capital accounts, we see that they are divided into intangible capital and tangible capital of which the former includes four secondary sub-divisions and the latter five primary divisions, which are again sub-divided so as to show a total of thirty-six secondary divisions. It is this classification which must be followed faithfully and conscientiously, if confusion is to be avoided. If it is strictly followed, it becomes a very easy matter to locate in a valuation report any particular inventory item which may be under discussion. Thus if the utility insists, after the valuation report is completed, that certain gas regulators temporarily in stock in the store room have been omitted, it is only necessary to turn to this classification and note that gas regulators are chargeable to Account C–25, though if they were in the store room as of

the date of the valuation, it would be reasonable to follow the clue that if they were not listed under Account C–25 they would be found under Stores and Supplies, which is an asset account and is included in the statement of working capital which usually follows the completed statement of plant accounts.

The five primary sub-divisions into which the tangible capital is divided are:

(*a*) Landed capital.
(*b*) Production capital.
(*c*) Transmission capital.
(*d*) Distribution capital.
(*e*) General capital.

The property chargeable to the thirty-six secondary accounts under these five primary accounts is largely subject to count in the field, though there must always be a general identification of the inventory from the office, in order that the work in the field should include all the properties of the utility and should not include properties belonging to others. Thus the identification of the inventory from the office might state with respect to production capital that certain blocks of land were owned by the company and that all of the holders, generators, buildings, fences and piping included in the lay-out belonged to the utility. It might be pertinent to remark here that in the case of a utility which has come into existence since uniform classification of accounts have been as satisfactory as they are at the present date, an inventory can frequently be worked out entirely from office records. An engineer of experience, however, can never conscientiously recognize such an inventory as having the same weight or accuracy as one which is based on the field inspection.

This sub-division of tangible capital into five groups makes it possible for the valuation engineer to distribute the work among responsible assistant engineers each one of whom may be familiar with one certain class of property, and not necessarily with any other class. Thus it is usually good practice to have the Landed Capital, Account C–5, Land devoted to Gas Operations, handled by an assistant engineer who devotes his entire time to lands, rights-of-way, etc. Similarly the building accounts seem to constitute a group by themselves; also the so-called "overhead expenditures," which are shown under Account C–35 and labeled "Undistributed Construction Expenditures," usually require the personal attention of the engineer who is responsible for the entire valuation. These so-called overheads include allowances for engineering, supervision, law, injuries, taxes and miscellaneous expenses, and are based largely upon judgment and experience, and it is but seldom that a satisfactory actual performance in a particular case is available for fixing the amount of

these arbitrary percentages. The property which is listed under Production Capital, Transmission Capital and Distribution Capital may usually to advantage be left to a man who is familiar with construction and operation of gas utility properties. If this work needs to be further subdivided as a matter of expedition, the responsibility for Production Capital can be given to an engineer who is familiar with machinery and its installation, while the mains which are involved in Transmission and Distribution Capital can be assigned to an engineer whose experience with hydraulic pipe lines has rendered him competent to discuss trenching, pipe laying, backfill, settling, replacing paving, etc.

After the inventory of such tangible property as can be found in the field is completed it becomes necessary to apply a unit price to each item in the inventory. In obtaining such unit prices for the column of Cost to Reproduce, the engineer is guided largely by whichever theory he is following in establishing the column of figures representing Cost to Reproduce. Inasmuch as these theories will be discussed later on under the topic "Cost to Reproduce," the subject need not be pursued further here.

We have said nothing so far about unit prices for the column of original cost. This is because figures would usually be derived figures, obtained by segregating the total expenditure actually incurred on a given piece of work among the inventory units, and then applying the unit prices thus obtained back again as a matter of multiplication to reach the total which is the original cost, and which was accepted as being correct. Consequently unit prices are rarely shown in connection with the column of total original cost, though the unit prices used in connection with the cost to reproduce are frequently obtained from an examination of original cost records. Since the figures of depreciated cost to reproduce are obtained as a percent of cost to reproduce it is not customary to work out unit prices for this column.

Leaving unit costs now, we come to the three columns of total cost, which are as follows:

1. Original Cost.
2. Cost to Reproduce.
3. Cost to Reproduce Less Depreciation.

Under Original Cost, it is usual to show actual expenditures, as taken from the books, after they have been carefully scrutinized to see that none of these expenditures include collusion. Also in connection with the work on the inventory items certain non-operative properties may be found and there may occur expenditures unwisely made. The non-operative property must be eliminated in a rate case, though not in a taxation matter and may frequently be included in the issuance of securities and may or may not be included in case of transfer. It is a rare

matter now-a-days to unearth evidences of collusion though it would be entirely easy to give specific instances. The ancient and most used device of allowing the grading on the railroad to be done at exorbitant prices by an independent organization whose officers are also the officers of the railroad company has been used once or twice in this state within the last decade under conditions that resulted in an original cost to the company very much in excess of a legitimate cost to reproduce. Similarly a mechanical engineer has occasionally received small private commissions or bribes in connection with the purchase of rolling stock or shop machinery, and many small irregularities can be unearthed in the office of the purchasing agent; however, it may be said that the valuation engineer but rarely unearths any expenditures involving considerable amount of dishonesty. An entirely different matter is presented in case a utility purchases a small plant to be included in its own larger plant, and pays for this small plant some amount of money or securities which exceeds the cost to reproduce of the elements constituting the plant. The gas utility may under the classification charge the entire cost to Account C–37, Plant Purchased in Lieu of Plant Constructed. However, the certainty that valuation proceedings will be had at some time in the near future frequently causes the utility to distribute this "cost of plant purchased" among the thirty-six accounts preceding. The utility will quite generally attempt to make such distribution in an honest manner and finds that it has paid in excess of the sum of such amounts as can properly be distributed to the tangible capital accounts. There is left something like 10 per cent to 25 per cent of the purchase price, which has to be shown on the books somewhere as having been expended and it is customary to show this under Account C–2, Franchises, or one of the other intangible accounts. When the valuation engineer finds this condition in original cost he uses his discretion. He may include or not include this charge in his column of original cost, but in any event he states the facts in detail so that the regulating body to which he reports may have the facts at its disposal and make such use of them as the particular proceeding may demand.

Coming now to the column of Cost to Reproduce, it is seldom that the engineer has specific instructions as to the conditions under which he is to reproduce the plant. He may reproduce an electric railway system or a gas utility piecemeal in the order in which it was originally constructed, thereby increasing the unit costs over what they would be if the entire plant were considered as a unit. To offset this he obtains an "Interest during Construction" considerably less by the piecemeal method than it would otherwise be. Also he must decide whether he will reproduce at present day prices or according to the actual price which the utility paid, or whether he will cover the entire life of the utility and get a weighted

average of all expenditures, in which case he obtains what is called a historical cost which should then be reconcilable in a very satisfactory manner with the adjusted original cost of the books. Inasmuch as the work of all the regulating bodies is subjected in some degree to review by the courts we must primarily look for help and guidance to the decisions of the Court. If we seek here, however, for a statement as to whether present day prices mean the quotation of the hour, which would probably be unreasonable, or the quotations of the last twelve months, or three years, or five years, or the quotations of the last several years projected into the future, we find very little assistance. For purposes of transfer, it seems that the present day prices should be given considerable weight. For purposes of rates it seems that the historical cost, in so far as it parallels investment or sacrifice, should be given most weight except perhaps in the case of lands. Between these two methods stands what has been termed by Mr. James T. Shaw of the Pacific Telephone and Telegraph Company in his argument in Application 1870 before the California Commission as the "actual performance" method. This method involves a careful scrutiny of the actual expenditures of the last three years or five years and the application of these unit costs to all items of property.

We will not here enter into a discussion of the merits of the various possible costs to reproduce, but will pass on to the last column "Cost to Reproduce Less Depreciation." In the earlier days of valuation engineering the distinction between the terms "cost" and "value" was not as clearly recognized as it is today and this third column was quite generally labeled "present value." The term was so very misleading that in spite of its brevity, it has quite generally been replaced by the term "Cost to Reproduce Less Depreciation." However, inasmuch as there are many different methods of estimating depreciation, the term is no more definite than the term "cost to reproduce." Fortunately the instructions which the valuation engineer receives are quite usually specific with respect to the use by him either by the straight line depreciation method, or the sinking fund depreciation method. Volumes upon volumes of discussion on the merits of these two methods might be cited. There was a time when the straight line method was much in favor. We believe that the time will come when it will be used but rarely. We have prepared quite recently a lengthy article on the fundamental conceptions involved in the two methods, and have been urged by so many public utility men and others to have the thesis published, that you may possibly find it in one of the next issues of Engineering and Contracting. The former or straight line method is clearly a method for retiring the investment year by year, and if in a rate case a depreciation allowance is granted the utility on the straight line basis then the interest return on the invested principal must decrease year by year as this invested principal is retired.

If on the other hand the rates accorded the utility include an allowance for depreciation which is based on the sinking fund method then there is no retirement year by year of the capital invested and the interest return on the investment remains a constant, year by year. Inasmuch as the straight line method is a re-payment year by year to compensate for the wearing out of the property and does not involve any interest rate of money, then if we take a property which cost $100, which will have to be replaced in twenty-five years and whose salvage value at the time of replacement is zero, it will be seen that the necessary annual depreciation allowance on straight line basis is $\frac{1}{25}$ of $100.00 or $4.00. By the sinking fund method, we do not re-pay the principal year by year in annual installments, but make such allowance as will, during the life of the property, compound to a sum equal to the cost of the property whose integrity is being guaranteed by this depreciation fund. Thus instead of paying $4.00 annually in the case cited above, we need to pay but $1.82. This seems to be advantageous to the rate payer, but it is so only in the earlier years. Thus if we add together the straight line depreciation and the interest return on the diminishing principal for one curve and add together the sinking fund depreciation and a constant interest return on the original investment for another curve, and allow these two amounts to vary as ordinates with time as an abscissa, we obtain two curves which, with the average utility, come to an intersection at from five to fifteen years after the inception of the utility. Before this intersection the straight line method demands higher rates than the sinking fund method; after this intersection, the reverse is true.

Thus far we have covered in a very brief and general manner that portion of the valuation report which includes the inventory, the unit prices and the three columns of cost which are usually demanded in such a report. We have already indicated that in addition to the property which can be inventoried as tangible property and identified and counted in the field, there are two other classes of property which come into the total plant which are not susceptible of such treatment. One of these is the so-called overhead expenditures which are classed as tangible capital and which involve allowances for engineering, law, etc. These expenditures might be distributed during construction days to those accounts in connection with which they would be incurred. Such distribution, however, would frequently be arbitrary and but little good would be accomplished by it. Consequently these expenditures, though many of them are incurred directly in connection with property, are nevertheless best carried as undistributed construction expenses and charged to Account C–35. Hardly a single valuation report has ever passed the scrutiny of any tribunal without the introduction of testimony as to the proper allowance for these so-called overheads. In the last big valuation

report which the writer has prepared, and by the way your own Professor Cory here prepared the company's inventory and appraisal, we were very fortunate in being able to obtain a so-called "actual performance" under operating conditions which might, nevertheless, yet be applicable to the construction conditions in connection with which these derived percentages were used. The average utility which is in operation as a going concern is generally interested at the same time in increasing its plant by new units of construction. The expenses of the general office which includes most of the overheads are then, as a matter of conservative accounting, charged entirely to that primary sub-account under operating expenses which is classed as "General and Miscellaneous Expenses." If we assume, and this must frequently be done, that it costs as much to administer $1,000,000 of expenditures in the way of operating expenses, as it does to administer $1,000,000 in the way of construction expenditures, then it becomes possible, where the books are carefully kept, to set up a fraction from which we can develop a satisfactory "actual performance" percentage for overhead expenditures. This fraction will have for its denominator the sum of charges to fixed capital Accounts C–5 to C–34, representing Landed Capital, Production, Transmission and Distribution Capital, and General Structures and Equipment and charges to operating expense Accounts E–1 to E–54 covering Production, Transmission, Distribution and Commercial Expenses. The numerator will include all charges to fixed capital Account C–35, Undistributed Construction Expenditures, and all charges to operating expense Accounts E–55 to E–77, General and Miscellaneous Expenses. This procedure has been worked out very carefully in connection with several recent valuations of gas utilities in this state and it is interesting to observe the remarkable agreement in total percentages applied to cover overhead in the gas valuation already referred to in which your own Professor Cory prepared the valuation from the utility's point of view and the writer was responsible for the work done in the engineering department of the California Railroad Commission. There was also a third valuation engineer involved in this case, representing the city within which this utility operates. If we lump together those overheads which are chargeable to engineering, supervision, law, injuries to persons, taxes, administration, fire insurance, transit insurance, casualty insurance and tool expense, we find that the city used a flat figure of 10 per cent of the base prices for the entire plant excluding real estate, services paid for by consumers and paving. On the same basis, the writer obtained, after a very thorough investigation, account by account, a total of 10.60 per cent; while the engineer for the utility, who prepared two different valuations on two different bases or theories, showed an average percentage of these two values amounting to very slightly over 11 per cent. We believe that in the future over-

head percentages can be worked out along these lines in such a manner that they will not in every instance be a cause of argument and dispute.

In order to complete the valuation of a gas plant it is yet necessary to make adequate allowance for the four intangible capital accounts, C–1 to C–4, including Organization, Franchises, Patent Rights, and Other Intangible Capital.

The next step in order to wind up the valuation is to make adequate allowance for contingencies, errors in computation and inventory omissions. One might think that errors in computation would balance each other, nevertheless experience seems to demonstrate that if any error occurs and gets past the checker it is frequently an error of the decimal where the amount shown is one-tenth of the proper product rather than ten times the proper product. It is easy to see why the latter class of error stands out prominently, while the former may be overlooked.

This completes the valuation report as far as the inventory and appraisal of the plant is concerned. In a rate case it will be necessary in addition, in order to develope a figure which will serve as a rate-base, to consider working capital, which includes the stores and supplies of Asset Account No. 9, and the working cash capital which necessarily must be tied up by a going concern. This leaves one more important item to be considered, namely Development Cost, and this frequently has been handled to advantage by the Accounting Department.

After the report is complete it will serve as a basis or starting point for conclusions as to transfer price in case of sale or condemnation proceedings, to tax-base for taxation, to rate-base for rate cases, and to security in case of the assumption of additional funded or unfunded financial obligations. The steps which are necessary before the valuation can be put into shape for use in connection with proceedings of any of these classes is quite a large subject by itself, and cannot be gone into here.

In closing it might be well to emphasize the fact that this paper as a whole may properly be considered as a syllabus only of the subject which it purports to cover in a general way.

If the general considerations which have been outlined here in such a very cursory and general manner have given you gentlemen something to think about and discuss with each other and with your instructors, the purpose of this paper will have been achieved.

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